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WATER STORAGE

IN

MONTANA

A Report Submitted To The

Fifty-fourth Montana Legislature

by

Governor Marc Racicot

pursuant to
Montana Code Annotated, Sec. 85-1-704 (1991)

January 1995

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I. INTRODUCTION

The Governor is required by statute to submit a report on water storage to the Montana Legislature each regular session. This report reviews current state water storage policy and statutory criteria used for prioritization of proposed projects. It identifies specific water storage projects proposed for development, including the rehabilitation of existing projects and two new projects. It also provides a summary of water storage rehabilitation projects in progress during the previous two years. Project descriptions include location, background, current status, and implementation strategy. Attached as appendix "A", is the justification for the prioritization of proposed water storage-related projects.

II. WATER STORAGE POLICY AND STATUTORY CRITERIA

The 1991 Montana Legislature passed into law a policy on water storage to define when storage is the best solution for solving specific water problems. If it is determined that storage is the best alternative, the policy identifies criteria to use in ranking state-funded projects (Sections 85-1-701 through 704 MCA). This law is based on the water storage section of the state water plan that was developed over a two-year period by three technical committees and the State Water Plan Advisory Council, with participation and advice from the Governor's Office and the Legislative Water Policy Committee. Montana's water storage policy is as follows:

> *The legislature recognizes that water resources needs are growing, existing water facilities are aging and in need of repair, and new water storage projects have become more difficult to complete. Other types of actions will be needed to solve many emerging problems, but if water storage is the best way to meet growing water needs and solve problems, then it should be actively pursued.*

In determining the best solution for a particular water management problem, the state shall:

a. carefully define the problem;
b. identify all options to solve the problem, including water storage;
c. determine whether water is physically and legally available to solve the problem; and
d. select the option that best meets the following criteria:
i. technical feasibility
ii. financial feasibility
iii. economic feasibility
iv. political feasibility
v. legal feasibility, and
vi. environmental feasibility

The statute continues by calling for this report to the legislature and describing its required contents. In addition, the statute identifies different criteria to be used to prioritize new water storage projects, storage rehabilitation projects, and budget priorities for the allocation of state water storage development funds.
Section **85-1-704** ***Prioritization of water storage projects - governor's report***, *states:*

(1) The governor shall submit to each regular session of the legislature a report identifying specific water storage projects proposed for development, including the rehabilitation of existing projects and new project proposals. The report must contain:
(a) a list of water storage project priorities;
(b) an implementation strategy for each priority project that identifies the resources (including specific budget requests), government actions, and other actions needed to accomplish the project; and
(c) a progress report on the development of water storage projects during the previous 2 years.
(2) In setting priorities among new water storage projects, the governor shall consider whether a project:
a) solves a severe water problem;
b) provides multiple uses and benefits;
c) provides for public uses;
d) shows strong evidence of broad citizen support;
e) is able to obtain non-state sources of funding;
f) protects and seeks to enhance social, ecological, cultural, aesthetic values;
g) improves local and state economic development;
h) could resolve Indian and federal reserved water rights issues;
i) supports water conservation activities; and
j) promotes the use of water reserved under Montana law.
(3) In setting priorities among water storage rehabilitation projects, the governor shall consider whether the project:
a) is needed to protect public safety;
b) has impacts if not repaired or rehabilitated; and
c) accomplishes the goals listed in subsection (2)(a) through (2)(j).
(4) In establishing budget priorities for the allocation of state water storage development funds:
a) First preference must be given to projects that resolve threats to life and property posed by high-hazard facilities that are in an unsafe condition;
b) Second preference must be given to projects that improve or expand existing water storage facilities; and
c) Third preference must be given to the planning and construction of new water storage facilities.

III. WATER STORAGE PROJECTS PRIORITIZED

The following water storage rehabilitation projects are classified as either state-owned or not owned by the state. They are prioritized using the criteria identified by state statute (MCA Section 85-1-704 (4) (a-c)):

State-owned Rehabilitation Projects

1. **TONGUE RIVER DAM REHABILITATION**
2. **PETROLIA DAM REHABILITATION**
3. **BEARPAW LAKE DAM REHABILITATION**
4. **NORTH FORK SMITH RIVER DAM REHABILITATION**
5. **DEADMAN'S BASIN WATER QUALITY IMPROVEMENT PROJECT**

Rehabilitation Projects Not State-owned

1. **LOWER BAKER LAKE SPILLWAY REHABILITATION**
2. **LAKE FRANCIS EAST DAM REHABILITATION**
3. **LONE TREE DAM REHABILITATION STUDY**
4. **TIN CUP LAKE DAM REHABILITATION**
5. **MALTA IRRIGATION DISTRICT CANAL EFFICIENCY IMPROVEMENT**

New Projects

1. **RUBY CREEK RESERVOIR STORAGE PROPOSAL**
2. **CHERRY CREEK RESERVOIR PROJECT**

IV. BACKGROUND AND IMPLEMENTATION STRATEGIES FOR PROJECTS

This section describes each project in detail. Project descriptions include background, current status, implementation strategy, and a summary.

A. REHABILITATION OF WATER STORAGE PROJECTS

Before discussing the projects, an understanding of a few basic principles and terms is important. Design standards have evolved considerably since the construction of many of the state's dams. A dam is classified as *unsafe* if its spillway is unable to withstand and route the percentage of a probable maximum flood (PMF) which is determined by the dam site's particular risk characteristics. A PMF is the flood that would result from a storm caused by a combination of extreme meteorological and hydrological conditions. Additionally, many storage projects are *unsafe* because they have deteriorated since construction and are in need of repair.

The highest priority for repair and rehabilitation is assigned to dams classified as *unsafe* and *high-hazard*. It should be noted that a dam is classified *as high-hazard* because its failure has the potential for loss of human life and not because of its structural integrity or condition. Repair of a project allows it to function as originally designed. Dam repair may not bring a facility up to current design standards. Rehabilitation involves upgrading existing projects to comply with or exceed current design standards and often includes repair work. The capacity of storage projects is often increased during rehabilitation if the enlargement is a cost-effective alternative.

The following projects are subject to the state's new statutory criteria because they are still in the planning stage. Some of these projects have been in the planning stage for years and others for only a short period of time. As the state's top priorities, the rehabilitation of the Tongue River and Petrolia Dams will require all funds currently available in the Water Storage State Special Revenue Account (Section 85-1-631 MCA). This account was designated by the Legislature in 1991 to allocate 25 percent of the grant funds available under the Renewable Resource Grant and Loan (RRGL) program to be used especially for water storage projects.

The RRGL program funds projects which promote water storage priorities established by the State Water Plan. The program was created in 1993 with the passage of House Bill 608 which combined the Water Development and Renewable Resource Programs into a single program. Prior to this change, applications for grants and loans for water project rehabilitation and new water-related projects could be submitted to either program for approval. Consequently, sections of this report may refer to funding from the Water Development Program if application was made prior to 1993.

TONGUE RIVER DAM REHABILITATION

The Tongue River Dam is located in southeastern Montana 10 miles north of the point where the Tongue River flows into Montana from Wyoming. The Tongue River carves a 265 mile-long valley from its headwaters in Wyoming's Bighorn Mountains to its confluence with the Yellowstone River at Miles City, Montana.

Description

The existing dam embankment is 91 feet high and 1,824 feet long, with a crest width of 55 feet. The reservoir has a surface area of 3,200 acres and a capacity of 67,000 acre-feet of water. The reinforced concrete spillway is 350 feet wide at its crest and 100 feet wide at its base. The maximum discharge capacity of the outlet works is approximately 4,000 cubic feet per second (cfs). The reservoir measures approximately 8 miles in length and averages one-half mile in width.

Background

As an interstate river, the Tongue River is subject to the terms of *The Yellowstone River Compact* between Montana, North Dakota, and Wyoming. The Tongue River project provides a reliable supply of water for the irrigation of 15,000 acres of land between the dam and Miles City. Nearly all the water used for irrigation supports alfalfa, feed barley, and pasture for the livestock industry. Water under contract from the project includes 39,300 acre-feet for irrigation, 7,500 acre-feet of which is dedicated for use by the Northern Cheyenne Tribe. The state fish hatchery in Miles City has contracted for 650 acre-feet and the St. Labre Mission in Ashland has contracted for 50 acre-feet of water. This amounts to a total of 40,000 acre-feet of contracted water.

During a moderate flood in May, 1978, the dam developed structural problems when spilling water severely eroded areas behind each of the wingwalls at the spillway's lower end. This damage took place during a spillway flow of 6,800 cfs. The spillway originally was designed to accommodate a flow of 98,000 cfs. The approximately $1 million in damage to the spillway during the flood of 1978 illustrates the deficiencies of the Tongue River Dam and underscores the magnitude of the threat posed by a large-scale flood.

A Corps of Engineers dam inspection culminated in the Tongue River Dam's classification as both an *unsafe* and *high-hazard* dam. The *unsafe* classification is based on the fact that the spillway's capacity to accommodate large releases is deficient.

If the dam failed, the region's economy would suffer greatly from the prolonged loss of irrigation and recreation opportunities. Estimated economic costs would range from $300 to $500 million. The Northern Cheyenne Tribe would lose its 7,500 acre-feet of

contracted water indefinitely. Important wildlife habitat also would be lost for a number of years. Since the flood of 1978, DNRC has, when possible, operated the reservoir at reduced capacity to avoid use of the spillway.

Current Status

Currently, the reservoir is able to provide a firm annual yield of 32,000 acre-feet, although it was designed to provide an annual yield of 50,000 acre-feet. The usable capacity of the reservoir is 68,040 acre-feet, and average storage amounts to 48,210 acre-feet. Because of abundant summer rains, the reservoir was full as recently as mid-July 1992. Under such conditions, a significant precipitation event easily could create a hazardous situation for the dam and the downstream population.

The Tongue River Reservoir is important to the settlement of the Northern Cheyenne Tribe's federal reserved water rights. A compact negotiated between the tribe and the state provides up to 20,000 more acre-feet of water annually to the tribe from the proposed dam rehabilitation and reservoir enlargement. It also protects the tribe's existing annual contract for 7,500 acre-feet of water. The legal settlement and the state's preferred plan call for construction of a new spillway with an additional 4 feet in crest height. The repair and enlargement of the dam will eliminate the dam's current *unsafe* status resulting in a safe structure and increasing the firm annual yield to 55,000 acre-feet. Legislation to ratify the settlement and authorize federal cost-share funding for the project was passed by Congress and signed by President Bush on September 30, 1992.

Implementation Strategy

Federal legislation requires the Secretary of the Interior to enter into a cooperative agreement for planning, design, construction, and environmental compliance on the Tongue River Dam project. That agreement was finalized on June 16, 1994. Work has begun on writing the draft environmental impact statement (DEIS). Final project design, which will last one and one-half years, will begin in mid-1995. After authorization, the final design stage will proceed and the federal-state joint EIS will be completed. Construction would begin during the fall of 1996 and be complete by fall of 1998. The proposed 1996-97 biennium funding arrangement for the Tongue River Dam rehabilitation project calls for $2,360,000 from water development funds and from the water storage account and $31,865,000 in federal funds for construction, mitigation, and enhancement.

Summary

The Governor's Office and DNRC have assigned a high priority to rehabilitating the Tongue River Dam due to its *unsafe* condition and *high-hazard* status. The project offers a viable solution to several significant water storage issues in southeastern Montana and satisfies the storage policy objectives of the state of Montana. As noted, the Tongue River project serves to settle the federal reserved water right claims of the Northern Cheyenne Tribe, supplements the supply of water in a semi-arid agricultural region, provides more opportunities for recreation, and appears to be environmentally compatible. Finally, the rehabilitation is a cost-effective solution as it both increases water storage capacity and addresses a potentially hazardous situation.

PETROLIA DAM REHABILITATION

The Petrolia Dam and Reservoir are located in Petroleum County on Flatwillow Creek. The dam is approximately 6 miles east and 5 miles south of the County Seat of Winnett, Montana. The dam impounds water from Flatwillow and Yellow Water Creeks, tributaries of the Musselshell River.

It is likely that DNRC will not be able to obtain an operating permit for Petrolia Dam because of the insufficient capacity and deteriorated condition of the dam's spillway. This means that the project may not be able to store irrigation water until the project is rehabilitated. This will pose a severe hardship for the Petrolia Water Users Association and have a negative impact on the economy of Petrolia County.

The estimated total construction cost is $1,434,000 which includes replacing the existing spillway, construction of a new auxiliary spillway, and seepage control in the embankment and left abutment. DNRC has budgeted $1,076,000 for rehabilitation and the Petrolia Water Users Association will pay the balance of $358,000 through a loan.

Description

The existing dam embankment is 59 feet high and the reservoir has a capacity of 8,360 acre-feet. The project currently serves 4,890 acres of irrigated land and supports a fishery. The maximum discharge capacity of the outlet works is 470 cfs. The capacity of the spillway was rated at 10,200 cfs at the time of construction.

Background

The dam was constructed in 1951 to meet the dam safety standards at that time. The dam is owned by the State of Montana and is operated and maintained by the Petrolia Water Users Association through water purchase contracts with DNRC. The Army Corps of Engineers (Corps) inspected the dam in 1980 under the National Dam Inspection Program. The dam was classified as *high-hazard* because its failure could result in loss of human life. The Corps declared the dam *unsafe* due to an inadequate spillway capacity to route the probable maximum flood (PMF).

In October 1982, DNRC contracted with Morrison-Maierle, Inc. to perform a seepage analysis and preliminary stability analysis at the dam. Their report stated that the dam was unstable and that the sandstone bedrock was allowing seepage to exit around the left abutment. Morrison-Maierle recommended a detailed stability analysis and further geotechnical studies at the dam (DNRC, 1985). DNRC contracted with HKM Associates to perform a complete rehabilitation feasibility study which was completed in November of 1986. The results of the study are discussed in the following paragraphs.

DNRC has conducted annual inspections at Petrolia Dam since the early 1970's. Several operation and maintenance (O&M) problems were identified and some emergency repairs have been made.

Current Status

The 1986 HKM feasibility report proposes measures that would provide adequate spillway capacity to pass the probable maximum flood (PMF), control seepage in the abutments, rehabilitate the outlet works, and rehabilitate or replace the principal spillway system. These measures would upgrade the dam to present dam safety standards. DNRC's review of the 1986 HKM feasibility report indicates the project can be rehabilitated for approximately $1,434,000.

Implementation Strategy

Probably, DNRC will not be able to obtain an operating permit for the project until the rehabilitation of Petrolia Dam is completed. The possibility exists that we will not be allowed to store water behind the dam for the 1995 irrigation season. DNRC and the Petrolia Water Users Association are presently working together to make the necessary small repairs to the project in an effort to ensure the spillway will safely pass a small runoff storm event.

The DNRC's Dam Safety engineers are analyzing the possibility of storing some amount of water in the project until major rehabilitation is completed sometime in the future.

Summary

The inadequate spillway capacity, poor spillway condition, and seepage problems warrant immediate rehabilitation. If rehabilitation efforts do not proceed, water storage operations will cease to prevent potential loss of life and damage to downstream property. The Petrolia Water Users Association is presently seeking a source of funding to assist with payment of the balance of construction costs. DNRC is continuing to analyze the lowest cost alternative in preparation for rehabilitation efforts beginning in the fall of 1995.

BEARPAW LAKE DAM REHABILITATION

Bearpaw Lake Dam is located on Beaver Creek within Beaver Creek Park, which is owned and operated by Hill County. The park is approximately 20 miles south of Havre, Montana.

Description

Bearpaw Lake Dam was constructed in 1958 and is owned and operated by the Department of Fish, Wildlife, and Parks (DFWP). The dam was constructed as a recreational resource and continues to serve that purpose. The zoned earthfill structure stands 59 feet high with a crest length of 380 feet. Lake levels are maintained by a two-bay, uncontrolled overflow chute spillway of reinforced concrete. A gated outlet works is available to release flows downstream as needed.

A center pier and the spillway side walls support a bridge for the road on the dam's crest, which is 20 feet wide. The reservoir's storage capacity is 535 acre-feet at the spillway crest, or normal pool and 905 acre-feet at the dam's crest. The lake's surface area is 36 acres and the drainage contains 49 square miles of land. Beaver Creek Reservoir, located 7 miles downstream, is a multi-purpose flood control, irrigation, and recreation project.

Background

The Army Corps of Engineers (Corps) classified the dam as presenting a "significant downstream hazard" potential in a March, 1980 inspection report. A 1980 Corps study of the Bearpaw Dam indicated that the dam would be overtopped when 9 percent of the probable maximum flood (PMF) takes place. In 1989, the dam was classified as *high-hazard* under Montana Dam Safety Act guidelines because of the potential for loss of life in the event of failure. A sudden breach of Bearpaw Lake Dam would damage bridges and the highway downstream and would endanger the lives of campers and recreationists who use the area extensively during the summer. No permanent residences are located downstream of the dam.

Current Status

A feasibility and risk-analysis study was conducted by an engineering consultant to determine whether Bearpaw Lake Dam would require complete rehabilitation, including spillway replacement, to meet Montana Dam Safety Act requirements. The study included a hydraulics analysis of the spillway and outlet works, watershed and flood hydrology, a geotechnical investigation and analysis, the preparation of rehabilitation alternatives, a recommendation of a preferred alternative, preliminary designs and cost estimates, an environmental analysis, and an estimate of future operation and maintenance needs.

It has been determined that repair of the dam will be sufficient to address the safety concerns at the site. Complete rehabilitation, including spillway replacement, would not lessen the impacts to the man-made features resulting from a PMF.

Implementation Strategy

In 1993, the Legislature appropriated $260,000 to DFWP for rehabilitation of the dam. Final design was completed by HKM Associates in 1994 and construction is scheduled for 1995. The selected repair alternative includes replacing a portion of the spillway floor and sidewalls, adding a parapet wall to the upstream face to increase freeboard (the distance between the top of the dam and the reservoir), replacing the existing bridge, and relocating the access road to avoid an existing slump.

Summary

DFWP and DNRC have worked with the consultant to determine the appropriate rehabilitation option. Repair is scheduled for the summer of 1995.

NORTH FORK SMITH RIVER DAM REHABILITATION

The North Fork of the Smith River Dam and its reservoir, Lake Sutherlin, are located about 10 miles east of White Sulphur Springs in Meagher County.

Description

The dam measures 84 feet high and 1,300 feet long at its crest, and stores 11,500 acre-feet of water at the spillway crest. The average storage is 9,000 acre-feet. The water is used to irrigate 11,000 acres of project land and provides considerable recreation opportunities.

Background

The dam was designed and constructed in 1936 to meet the dam safety standards of that time. Owned by DNRC, it is operated and maintained by the Smith River Water Users Association through water purchase contracts. The Army Corps of Engineers (Corps) inspected the dam in 1980 under the National Dam Inspection Program. The dam was classified as *high-hazard* because its failure could result in loss of human life. The Corps declared the dam *unsafe* due to an inadequate spillway capacity to route the probable maximum flood (PMF).

Current Status

During the spring of 1989, DNRC contracted with HKM Associates, a consulting engineering firm, to perform a feasibility study for upgrading the dam to meet current federal and state dam safety standards. The study includes a geotechnical investigation, a flood hydrology analysis and subsequent spillway design, a water availability analysis, a rehabilitation plan with cost estimates for various alternatives, an environmental assessment, and a project evaluation that addresses the financial and economic feasibility of rehabilitation. Draft hydrology, geotechnical, and cultural resources reports have been completed.

The preferred dam rehabilitation alternative would increase the spillway capacity by constructing an auxiliary spillway to pass the appropriate spillway design flood. A loan of $1,393,467 through the Renewable Resource Grant and Loan (RRGL) program was approved by the 1993 legislature. The preferred alternative, however, has been revised since funding for the project was approved by the legislature. DNRC is re-evaluating the spillway capacity based on new Dam Safety criteria and it appears that a spillway which is smaller than originally anticipated may be proposed. The revised project will rehabilitate and increase the capacity of the existing principal spillway, construct an

auxiliary spillway, level the dam crest, and improve seepage collection at the dam. The project will cost between $250,000 and $500,000.

Implementation Strategy

Final design will begin once the feasibility study has been completed. At that time, the preferred alternative will be refined and a final engineer's cost estimate will be prepared. Although DNRC owns the land up to the existing dam crest elevation of 5496 feet, flood easements with private landowners and the state are necessary for about 120 acres of additional land needed for the flood pool. DNRC will purchase land needed for the auxiliary spillway.

Work that has yet to be completed includes a structural stability analysis of the existing and proposed dam embankment, feasibility study, final design of the dam rehabilitation, engineering cost estimate, cultural resources mitigation plan, final hydrology and geotechnical reports, and the preparation of construction contract documents. The project schedule for the North Fork of the Smith Dam rehabilitation calls for construction to begin in the fall of 1996.

Summary

An RRGL loan for $1,393,467 at 4.5 percent for 20 years was approved by the 1993 legislature. The proposal to rehabilitate the North Fork of the Smith River Dam satisfies state law by giving funding preference to an *unsafe, high-hazard* facility. The construction of an auxiliary spillway, rehabilitation of the existing spillway, and leveling of the dam crest reduces the potential for damage to life and property while maintaining the reservoir for irrigation and recreational uses. DNRC is negotiating with the water users association for repayment of the revenue bond.

DEADMAN'S BASIN WATER QUALITY IMPROVEMENT PROJECT

Deadman's Basin is a Department of Natural Resources and Conservation (DNRC) water storage project located 22 miles east of Harlowton in eastern Wheatland and western Golden Valley counties.

Description

The project, operated and maintained by the Deadman's Basin Water Users Association (DBWUA), impounds 72,220 acre feet of water and irrigates approximately 26,000 acres. Deadman's Basin releases water through two outlet canals: the Careless Creek Canal and the Barber Canal.

The Lower Musselshell Conservation District has determined that water quality on the lower Musselshell River can be improved by decreasing flow rates in the Careless Creek outlet canal thereby reducing erosion and sediment transported in Careless Creek.

To maintain historic flow releases from storage, the flow rate will be increased in Barber Canal to compensate for the loss in flow in Careless Creek Canal. Increased flow rate in the Barber Canal will require canal rehabilitation and enlargement. The Deadman's Basin Water Quality Improvement Project will increase the current capacity of the Barber Canal from 200 cubic feet per second (cfs) to 300 cfs and decrease flow in the Careless Creek Canal from peak discharges of 250 cfs to less than 150 cfs.

Background

The Careless Creek canal uses about 6 miles of the natural creek channel to convey the water to the Musselshell River. Release of clear stored water into this drainage has resulted in considerable erosion of sediment into the Musselshell River. This plan involves releasing a larger percentage of the water to the Musselshell River through the Barber Canal, which discharges directly to the river. Enlargement of several drop structures will be required and the canal must be stabilized to accommodate the higher flows.

The rehabilitation project is comprised of four phases. The first phase was initiated in 1993. A failed drop structure provided an opportunity to replace the drop with a 300 cfs structure. This phase was successfully completed through a joint effort by Golden Valley Agricultural Stabilization and Conservation Service (ASCS), DBWUA, DNRC, and the Soil Conservation Service (SCS).

The second phase of the project will involve repair and enlargement of the stilling basins below existing structures and armoring of the outside bends of the Barber Canal. The

third phase will be a feasibility study and design for increasing the capacity of the three existing drop structures that now limit flow capacity. The final phase of the project will be upgrading Barber Canal to deliver 300 cfs to the Musselshell River. The project is technically feasible.

This proposal includes the second phase of construction work and engineering services for the third phase.

Current Status

DNRC is requesting both a loan and grant totaling $160,000 for beginning construction on enlarging of the Barber Canal and to contract consulting engineering services to develop a rehabilitation plan for the existing concrete structures in the Barber Canal. Total project cost is $191,675. DBWUA will contribute $32,675.

Implementation Strategy

This proposal involves repair and enlargement of the stilling basins below existing structures and armoring of the outside bends of the Barber Canal. It also includes a feasibility study and design for increasing flow capacity of the three existing drop structures that now limit flow capacity.

Coordination with the DBWUA, ASCS, DNRC, the Natural Resource Conservation Service (formerly the SCS), and the Bureau of Reclamation is expected. The budget and schedule are reasonable for the scope of work.

Summary

DNRC is requesting both a loan and grant totaling $160,000 to begin enlarging the Barber Canal and to contract for consulting engineering services to develop a rehabilitation plan for the existing concrete structures in the Barber Canal.

This project supports the Montana State Water Plan objectives of integrating water quality and quantity management. It supports the intent of the plan by encouraging water quality improvement by local water users. The project is well supported by the local community.

This project is preferable to the more costly alternative of stabilizing Careless Creek with higher flows.

LOWER BAKER LAKE DAM SPILLWAY REHABILITATION

Lower Baker Lake is a man-made lake located a short distance east and south of the town of Baker in Fallon County. It is used by the local public primarily for recreation.

Description

Lower Baker Lake has existed for over 80 years. The lake's dam was built in 1914 by the Chicago, Milwaukee, St. Paul & Pacific Railroad. The lake is an important resource to the residents of the area and to birds and wildlife. The U.S. Army Corps of Engineers (Corps) evaluated the dam's concrete spillway and reported it as being in poor condition. The future of the lake is linked to the integrity of the dam's spillway. It is important that the spillway be replaced before a significant flood occurs.

The proposed rehabilitation project involves replacing the existing spillway to meet requirements of the Montana Dam Safety Act. The existing concrete spillway drop structure would be replaced with a new concrete one. The spillway channel upstream of the structure would be cleared of trees, brush, and vegetation and lined with rock for stabilization. Personnel from the Montana Department of Natural Resources and Conservation (DNRC) Dam Safety Program have participated in planning and supporting the proposed project.

Background

Fallon County obtained ownership of the Lower Baker Lake Dam in 1977. In 1979, the Corps inspected the dam under the National Dam Safety Program. The inspection report classified Lower Baker Dam as *high hazard* because failure of the dam could result in loss of human life. It was also classified as *unsafe* due to the deteriorated condition of the spillway's concrete. The Corps report concluded by noting that this situation could result in the dam's failure under flood conditions. In 1985, the county attempted to repair the toe of the concrete drop structure where it was deteriorating due to undercutting by spillway flows. This was only a temporary solution as the spillway's concrete has once again begun to deteriorate.

Current Status

The concrete is now beyond repair and the entire spillway drop structure must be rebuilt. The spillway is the only discharge outlet from Baker Lake. If a flood should occur, it is predicted that the existing spillway will fail. This will result in the loss of numerous resources, including water, land, wetland vegetation, fish, wildlife, birds, recreation, public property, private property, and possibly, human life.

Implementation Strategy

The total cost of the proposed project would be $63,632.39. Fallon County has requested a grant from the Renewable Resource Grant and Loan Program in the amount of $31,742.76. The program has recommended that the legislature approve a grant of $15,908.00 and a loan of $15,835.00. Fallon County has proposed to contribute an in-kind match for administration, surveying, labor, equipment, and materials. The project can be completed within five months after funding is obtained.

A professional engineer will provide the design, bid specifications, construction specifications, and construction monitoring. A contractor will be selected to construct the concrete drop structure. Small trees and shrubs must be removed from the area between the spillway and the lake surface to comply with the Dam Safety Act. This area also requires leveling and installation of a rock surface to prevent erosion. The County has agreed to clear the drop structure construction site and install the rock surface in the spillway channel. All design and construction of the spillway will be coordinated with DNRC Dam Safety Program personnel.

Approved grant and loan funds will be provided after DNRC approves a scope of work and budget, and after matching funds have been secured. The project sponsor must arrange a prescriptive easement to construct a portion of the drop structure on private land. Original specifications, design, and revisions will be submitted to and approved by the DNRC Dam Safety Section before any bids are solicited.

Summary

Rehabilitation of the Lower Baker Lake Dam would address the unsafe conditions identified by the Corps and DNRC by replacing the current dilapidated spillway with a new concrete spillway capable of routing two-tenths of the probable maximum flood. DNRC has indicated that the new spillway will meet the requirements of the Montana Dam Safety Act.

The project would directly implement objectives of the water storage section of the State Water Plan by allocating state funds to resolve threats to life and property posed by high-hazard facilities in an unsafe condition. This project also meets several criteria for prioritizing rehabilitation of water storage projects including: solving the most severe problems (*unsafe, high-hazard* facility); providing multiple uses and benefits (would maintain use of lake for recreation, fish and wildlife, and wetland areas); providing public uses (recreation); have the ability to obtain non-state sources of funding (Fallon County will contribute half of project costs); and protecting and enhancing ecological and aesthetic values and public safety.

LAKE FRANCIS EAST DAM REHABILITATION

Lake Francis is located approximately 15 miles northwest of the City of Conrad in the west central region of the state. The reservoir holds an average of 86,000 acre-feet of water and is owned by the Pondera County Canal and Reservoir Company, which uses the stored water for irrigation. Conrad obtains its entire municipal water supply from the reservoir via a pressurized pipeline originating at the outlet conduit of the Lake Francis East Dam. The City of Conrad water system serves an estimated 3,075 users.

Description

The proposed improvements include excavating the existing pool below the dam, installing intake piping, relocating existing pumps, and adding a new pump, pump house, discharge piping, and controls. The new 30 horsepower pump will more closely match system average demands than the existing 100 horsepower pumps, resulting in energy savings. Water will be conserved by improving the control of discharges from the dam.

The improvement of the city's water system will enhance public health and safety. This project is required to comply with the National Dam Safety Program and was ordered by DNRC in accordance with Public Law 92-367.

The total estimated project cost is $360,000 (based on 1996 dollars). The City of Conrad is seeking a $100,000 Renewable Resource grant, a $180,000 TSEP (Treasure State Endowment Program) grant and a $3,500 Montana Power Company grant (Efficiency Plus Business Partners Program). The city will document city expenditures of $76,500.

Background

Based on inspections of the Lake Francis East Dam in the 1980's by an engineering firm under contract with the Army Corps of Engineers, and more recently by Morrison-Maierle, Inc., the Lake Francis East Dam is classified as *high hazard* because its failure has the potential for loss of human life. A leak in the section of the city's water supply pipeline--the outlet conduit located within the east dam's earthfill embankment--could saturate the dam resulting in the dam's failure. Removal of the outlet conduit and other improvements will eliminate this risk. Several major system upgrades have occurred in the last 25 years including: 1) the replacement of 65,000 lineal feet of pipeline, 2) the construction of a direction filtration plant, and 3) the construction of two 1 million gallon storage tanks.

In 1982, the city conducted a study to determine what alternatives were available for diverting water from Lake Francis to Conrad. The three alternatives studied ranged from $670,000 to $1,400,000 in cost. In 1994, another study determined that a solution costing $360,000 was available involving alterations to the outlet pool below the dam.

The proposed improvements include excavation in the existing pool below the Lake Francis East Dam, new intake piping, relocation of existing pumps, installation of a new pump, and the construction of a pump house with new discharge piping and controls.

Current Status

Conrad has retained an engineer to determine the improvements required to comply with the operation permit. The proposed improvements have been reviewed by the dam owners, the engineer, and DNRC. The estimated project cost is $360,000. A preliminary engineering study including a cost estimate of the alternatives is included in the proposal. The proposal states that the operation and maintenance costs will not change. The project is financially feasible although additional funding sources must be secured.

Implementation Strategy

The project should be completed by spring 1996 to meet DNRC's dam operating permit condition. The engineering design could be completed by fall 1995, assuming interim funding is available. The lands needed for the proposed construction improvements are owned by the Pondera County Canal and Irrigation Company. All easements and rights-of-way will be provided to the city by the Pondera County Canal and Irrigation Company. Grant funds will be available after DNRC approves a scope of work and budget, and after matching funds have been secured. Original specifications, designs, and revisions will be submitted to DHES for approval before bids are solicited. The proposal states that approvals of both DNRC and DHES will be obtained prior to construction.

Summary

This project will result in a cost effective solution to the City of Conrad's water supply needs and address the potential threat posed by an *unsafe* dam. The total estimated project cost is $360,000, based on 1996 dollars. The City of Conrad is seeking a $100,000 Renewable Resources grant from the Montana Legislature, a $180,000 TSEP grant and a $3,500 Montana Power Company grant. In addition, the city will document city expenditures of $76,500.

This project directly implements objectives of the state water plan section on water storage. It proposes to allocate state funds for water storage rehabilitation projects based on resolving threats to life and property posed by *high-hazard* dams that are in *unsafe* condition and improving or expanding existing water storage facilities.

If the Lake Francis East Dam were to fail, not only would a serious threat to downstream life and property occur, the sole water supply source for the City of Conrad would be eliminated, resulting in an urgent and serious public health problem.

LONE TREE DAM REHABILITATION STUDY

The two Lone Tree Dams are located on Lone Tree Creek 3 miles west of Sidney, Montana.

Description

Lone Tree Ranch, Inc. is the owner of both dams. The existing project consists of two earthfill dams known as Vaux I and Vaux II. Vaux II is located one-half of a mile upstream of Vaux I and impounds 600 acre-feet of water at normal pool and 1175 acre-feet at the crest of the dam. As of November, 1992, Vaux I was drained and Vaux II filled to normal pool level. Vaux I, the lower dam, impounds 250 acre-feet at normal pool and 685 acre-feet at the crest and provides the only regulation for irrigation releases. The Lone Tree Creek drainage measures approximately 83 square-miles in area.

Background

The dams originally were constructed to provide the Lone Tree Ranch with irrigation water. The original Vaux I was built in 1936 and measured approximately 20 feet high. The original Vaux II dam was built in 1944. In 1947, the height of Vaux II was raised to 40 feet and a spillway was constructed.

On March 26, 1951, both the Vaux I and II dams failed from overtopping during a high runoff. An ice jam on the crest of the Vaux II dam reduced the capacity of the spillway. After overtopping, a 200-foot section of the north abutment washed out. This caused Vaux I to overtop, washing out a 400-foot section of its south abutment. The failure caused extensive downstream flooding that included portions of Sidney. Although there was significant property damage in Sidney, no human lives were lost. Reconstruction of the dams in 1960 involved repair of the breached sections on both dams, and construction of a new spillway at the Vaux II Dam.

A considerable amount of residential development exists in the floodplain of the dams. This development proceeds without consultation with the owners of the dams. A 1978 engineering study by the Corps resulted in the dams being classified as *high-hazard*. This classification is based on the potential for loss of human life in the event of dam failure. The dams are also classified as *unsafe* due to inadequate spillway capacity and will require extensive modification to comply with Dam Safety Act regulations. Because the cost of private rehabilitation is prohibitive, Lone Tree Ranch, Inc. has considered breaching the dams to relieve itself of liability in the event of failure.

Current Status

Richland County and the City of Sidney are concerned about flood protection for downstream residential development, the hospital, and the airport. The County has received a $60,850 grant through the Renewable Resource Grant and Loan (RRGL) program for a detailed engineering study and cost-benefit analysis of the rehabilitation of the dams. The results of the study will provide information needed by Lone Tree Ranch, Inc., the City of Sidney, and Richland County to evaluate alternatives for bringing the dams into compliance with the Dam Safety Act. The geotechnical report is finished and the final construction drawings are expected to be completed in January of 1995.

Lone Tree Ranch, Inc. contributed $9,900 of the $70,750 total funding needed for the study. In addition to support from Richland County and the City of Sidney, DNRC has identified rehabilitation of the dams as a top priority. The costs outlined in the grant application and the objectives of the study are well-documented and adequate.

Implementation Strategy

Final plans and specifications will be submitted in January of 1995 and construction will begin in May of 1995. The plans call for raising the existing dam and adding a second spillway on Vaux II. Vaux I will be modified so that there will be no structurally controlled discharge. Also, due to liability concerns and the costs of rehabilitation, the owners may choose to breach the dam.

Summary

The Lone Tree Dam rehabilitation study meets the criteria for funding of water storage rehabilitation projects set forth in Section 85-1-704 (3) MCA. Projects that are needed to protect public safety and that avert negative impacts are granted highest priority. In 1978, the Corps classified the Lone Tree Dams as *unsafe* due to the inability of the dam spillways to route the probable maximum flood (PMF), and *high hazard* because of the threat to human life in the event of dam failure.

The dams would continue to provide water for irrigation and flood protection if rehabilitation is a viable alternative. Broad public support for the study exists if recreation opportunities would be made available. The dam owner has committed 15 percent of the funds needed for the proposed study and as potential project beneficiaries, Richland County and Sidney have been asked to contribute to the project costs.

In conclusion, the condition of the dams presents the potential for loss of human life and for negative economic impacts. The proposal is consistent with the statutory criteria that support funding dam rehabilitation.

TIN CUP LAKE DAM REHABILITATION

Tin Cup Lake Dam is located at the headwaters of Tin Cup Creek near the Montana-Idaho border approximately 14 miles southwest of Darby, Montana. The dam is located within the Selway-Bitterroot Wilderness Area of the Bitterroot National Forest.

Description

Tin Cup Lake Dam is an earth embankment structure 25 feet high. The dam has a crest width of 10 to 17 feet and a crest length of 437 feet. The dam has an active storage capacity of 2,420 acre-feet. The total storage capacity, to the dam crest elevation, is 2,800 acre-feet.

The primary purpose for the dam is to store water for irrigation and to supplement the natural creek water supply during late summer. The dam supplies irrigation water to approximately 1,300 acres of farmland. Additional benefits of the dam include limited flood control, ground water recharge, enhancement of instream flows for fisheries, public recreation opportunities, and improved water quality through the control of streambank erosion and stream sedimentation.

Background

Several modifications to the dam have been made since 1906 when it was originally constructed. However, the active storage of the dam has not been increased over the years. The dam is currently owned and operated by the Tin Cup Water Users Company, an organization of 54 local farmers and ranchers. The Tin Cup Water Company is planning to apply to the state to form a public water district.

Current Status

Tin Cup Lake Dam was inspected by the U.S. Army Corps of Engineers (Corps) in 1980 under the National Dam Inspection Program. The dam was classified as *high-hazard* by the Corps, the U.S. Forest Service and DNRC. At least four residences, several private, County, and State roads, bridges and utilities, and several hundred acres of agricultural land would be adversely impacted if the dam failed. The dam was originally classified as *unsafe* because of inadequate spillway capacity to route the probable maximum flood (PMF). However, the Forest Service is now considering a reclassification of the dam based on a National Weather Service dam breach model named "BREACH". This model is based on the soil characteristics of the embankment and attempts to simulate the erosional failure of the dam using soil physical properties. In other applications, the BREACH model resulted in lower downstream peak failure flows, creating less hazard as

it simulates flow in the channel valley. The results of this model may change the Forest Service's classification of the dam which would allow less stringent criteria for the dam and spillway.

Implementation Strategy

The Tin Cup Water Company contracted with the consulting engineering firm of Druyvestein, Johnson and Anderson to develop alternatives for bringing the dam into compliance with current dam safety standards. A detailed study of the dam has been completed and the consultant has recommended the following major changes to the structure:

1) Improve the existing embankment by raising the dam crest approximately 2 feet, regrade and establish a constant slope on both the upstream and downstream faces of the structure, and place additional riprap protection on the upstream face of the dam.

2) Improve the spillway by replacing the existing deteriorated rock and mortar spillway crest, widen the spillway by approximately 20 feet, and upgrade the existing debris log boom arrangement and add additional riprap to the inlet and outlet channel slopes.

3) Improve the existing inlet and outlet works by replacing or lining the existing stone and mortar box culvert, replace the existing log tower and inlet crib, replace the existing headgate, and install a reservoir level recording device.

The storage capacity of the reservoir will not be increased. Druyvestein, Johnson and Anderson has estimated the cost of rehabilitation to be $280,742. A loan through the Renewable Resource Grant and Loan (RRGL) program for $304,204 at 3 percent interest for 20 years was approved by the 53rd Montana Legislature for the dam's rehabilitation.

The dam is located entirely within the boundaries of the Selway-Bitterroot Wilderness Area. Special dispensation must be granted by the U.S. Forest Service for the rehabilitation project because motorized construction equipment is authorized for use in wilderness areas only for repair that cannot be done adequately without motorized equipment. Use of such equipment is specifically controlled under five-year special use agreements for maintenance of wilderness dams.

Summary

The Tin Cup Water Company is in the process of becoming a public entity to qualify for use of their approved loan. If the Forest Service reclassifies the dam as something less than *high-hazard*, the scope of work for compliance with dam safety standards will be reduced. Some repair work is necessary due to the deteriorated condition of the dam and spillway. It is premature to estimate when construction can commence.

MALTA IRRIGATION DISTRICT CANAL EFFICIENCY IMPROVEMENT

The proposed project is the Dodson South Canal, which delivers water from the Milk River to Nelson Reservoir approximately 20 miles northeast of the town of Malta, in northcentral Montana.

Description

The Dodson Canal water distribution system is operated and maintained by the Malta Irrigation District which has received a $50,000 grant through the Renewable Resource Grant and Loan (RRGL) program to rebuild eight check structures in the Dodson South Canal. The projected cost is $498,000. The completed project would allow an additional 13,000 acre-feet of water to be stored annually at Nelson Reservoir. Nelson Reservoir would need to be filled before the nesting period of the piping plover, a "threatened species" under the Endangered Species Act. Increased storage would allow water to be conveyed more efficiently into Nelson Reservoir.

Background

The Malta Irrigation Project was constructed between 1909 and 1923 and includes 42,492 acres. The Malta Irrigation District is responsible for operating and maintaining the Dodson South Canal. The U.S. Bureau of Reclamation (BOR) conducted an irrigation system rehabilitation and betterment study and concluded that new check structures were needed to improve the efficiency of the irrigation system. When water in the canals is at less than full capacity, check structures would raise the water high enough in the canal for it to pass through the turn-outs in the canal banks. The new automated check structures will be designed to BOR standards and will have two 10-foot wide bays instead of the current 5-foot wide openings.

The automated check structures will allow water to be stored at Nelson Reservoir beginning two weeks earlier each spring. During springtime, melting pieces of ice tend to block flows through the 5-foot check structures. The two ten-foot bays of each structure will allow ice to pass through without much difficulty. It is important to begin storing water at Nelson Reservoir as early in spring as possible because the piping plover nests from May 1 to July 15 on the reservoir shoreline. This migratory shorebird is classified as a *threatened species* under the national Endangered Species Act. Storage during this period may result in flooding of nesting areas which can increase mortality rates of the piping plover.

BOR has an agreement with the U.S. Fish and Wildlife Service to maintain water levels in Nelson Reservoir that are compatible with the critical plover nesting period. Storing water before the piping plover nesting period is also important to the local agricultural economy. The majority of local runoff usually takes place over a very short time period. It is estimated that at the maximum flow of 500 cubic feet per second, the proposed automated check structures will allow the storage of an additional 13,000 acre-feet of water each year without interfering with the piping plover nesting season. Bowdoin National Wildlife Refuge, which contains 8,000 acres of waterfowl habitat and receives water from the Milk River via the canal system, also will benefit from the proposed project by receiving additional water earlier than usual.

Current Status

The Malta Irrigation District received a $50,000 RRGL grant from the legislature. A grant of $100,000 had originally been requested. The estimated cost of the proposed project is $498,000. The $398,000 difference will be covered by the Malta Irrigation District through user fees. Three of the eight check structures have been installed. Two others are 50% completed and are expected to be finished by April of 1995. Two more are expected to be constructed next year and the final structure is expected to be completed in April of 1997. The grant extends through September of 1997.

Implementation Strategy

An environmental assessment by BOR and DNRC is required under the Montana Environmental Protection Act and the National Environmental Protection Act. The Endangered Species Act also must be reviewed because of the documented piping plover nesting activity at Nelson Reservoir.

The Malta Irrigation District manager supervises all construction activity. The project construction schedule calls for installing two of the eight proposed check structures each year through 1996. The replacement structures are all alike and are placed at the location of the existing structures. Yearly construction begins during the last week of October after the canal is drained and is completed by mid-December.

Summary

The Malta Irrigation District's Canal Efficiency Improvement Project has met the statutory requirements for rehabilitation prioritization. Projects that have negative impacts if not repaired or rehabilitated receive priority second only to those that are needed to protect public safety. BOR conducted a "rehabilitation and betterment" study of the Malta Irrigation District irrigation system and found that new check structures at Dodson Canal South were critical to keeping the water distribution system operational.

The proposed project addresses the deficiencies with the water conveyance and distribution system. The state's water policy identifies the improvement of existing water storage facilities as a priority in the allocation of state funds. This region has been experiencing drought conditions in recent years. The proposal addresses this potential water deficit by improving the existing system and the water storage capacity within the constraints imposed by the Endangered Species Act and a limited time period for capturing critical run-off. It should be noted that the piping plover does not directly benefit from this project, although it should be protected from adverse side effects that the project may pose.

The proposed project provides more water for irrigation, for migratory bird habitat, and for recreation. The Malta Irrigation District and the Glasgow Irrigation District will benefit from the increased ability to store water within the seasonal and environmental constraints. Public flatwater recreation opportunities should increase at Nelson Reservoir due to the increase in pool size. Fish habitat should be improved with the increase in reservoir volume. The potential exists for more storage at Bowdoin National Wildlife Refuge, which would benefit bird and wildlife habitat. No citizen opposition to the project has been documented.

In conclusion, the proposed project will increase the efficiency and rehabilitate the existing water conveyance system. Approximately three quarters of the project funds will be generated by the irrigation districts through user fees. The project will also reduce seepage from the canal and decrease the salinity of adjacent lands, improving water quality. The proposed project benefits are supported by goals identified in the state water plan and the legislation governing the allocation priorities of water storage funding.

B. NEW STORAGE PROJECTS

There are two new storage projects currently in the planning stages.

The Ruby Creek storage project is located in the Upper Big Hole Valley approximately 10 miles west, southwest of Wisdom, Montana and two miles east of the Big Hole Pass and the Montana Idaho border. The feasibility study is being conducted by the U.S. Bureau of Reclamation (BOR) Montana Projects Office with the cooperation of several Big Hole Valley irrigators, DNRC, and DFWP. USGS is assisting in water measurement and the U.S. Forest Service (USFS) has an interest since the project lies on USFS land and a small population of westslope cutthroat trout resides in the upper reaches of Ruby Creek and its tributaries.

The Cherry Creek Reservoir Project is located near Terry, Montana. This project is sponsored by the Bureau of Land Management (BLM). The project is intended to provide recreational opportunities for visitors and residents of the region. No state funding is currently being requested for the project.

1) RUBY CREEK RESERVOIR STORAGE PROPOSAL

The site for the proposed Ruby Creek Reservoir is located on Ruby Creek 10 miles west, southwest of Wisdom, Montana and two miles east of Big Hole Pass and the Montana-Idaho border. The proposed dam would measure approximately 60 feet in height, 2100 feet in length, and would impound about 4,000 acre-feet of water creating a reservoir surface area of 180-200 acres. The project would supply supplemental water to 5,000 acres of irrigated lands and a firm yield of water to Swamp Creek, spawning habitat for the fluvial arctic grayling. This potential benefit of the project would increase the financial feasibility of the proposal. The reservoir may provide opportunities for limited flatwater recreation. The applicant is the Ruby Water Company of Wisdom.

Description

Ruby Creek originates along the Continental Divide on the east side of Big Hole Pass in the Beaverhead National Forest. Ruby Creek is a perennial stream and a tributary of the North Fork of the Big Hole River which is a tributary of the Big Hole River. Ruby Creek meets Trail Creek approximately 8 miles north of the proposed reservoir to form the North Fork of the Big Hole River which then enters the Big Hole National Battlefield just off state route 43, 10 miles west of Wisdom. Several small tributaries join Ruby Creek within and above the proposed impoundment area which is located at an elevation of 6664 feet above sea level. Ruby Creek historically provides irrigation water for native hay crops on several ranches in the Upper Big Hole River Valley.

One aspect of the proposal involves supplementing streamflow in nearby Swamp Creek which is a primary spawning stream for the only remaining native population of river-dwelling arctic grayling in the contiguous 48 states. Water from Ruby Creek can be diverted to Swamp Creek via a small irrigation canal that transverses the gentle divide between the drainages of Ruby and Swamp Creeks. The fluvial arctic grayling is listed as a "Species of Special Concern" by Montana DFWP. The fact that this proposal would provide additional benefit for the grayling increases its potential for broader support by the public and its financial feasibility.

Background

The Soil Conservation Service (SCS), now the Natural Resources Conservation Service (NRCS), studied the feasibility of a water storage project at this site in the late 1960's. In 1968, a report to the present applicants indicated that the cost of a 60-foot high dam storing 3600 to 4000 acre-feet of water would be approximately $300,000. The project was not pursued further because the applicants were unsuccessful in negotiating a land trade with the USFS for a portion of land that would be inundated by the reservoir. In 1990, the applicants made application for a special use permit with the USFS for the project and applied to the DNRC for a grant under the Renewable Resources and Water Development program. The USFS special use permit is under review pending a study of the mineral claims in the subject area.

In 1991, the Montana Legislature granted the applicants a water development grant of $14,708 to conduct a feasibility study of the proposal. The applicants met with representatives of DNRC, DFWP, USFS, and BOR in August of 1993 to visit the project site and to plan the studies needed to determine economic and hydrologic feasibility. BOR was able to provide technical assistance in 1994 to DNRC for this phase of the study from its Technical Assistance Program to States. Continued assistance under this program has been requested by DNRC for 1995-96 and tentatively approved by BOR.

A network of 5 stream gauging stations was activated in May of 1994 and flows were recorded through October 1994. The flow data was summarized for the 1994 season using comparisons with other streamflow records collected at gauges in the area and a hydrologic water supply computer model. The data and conclusions from the first year of study were presented by BOR for comment in the draft report entitled "Ruby Creek Water Availability Study Near Wisdom, Montana, October 1994." The final 1994 study will be issued early in 1995.

Current Status

The feasibility study provides early indications that the water necessary for the project may be available. However, due to the fact that no adequate period of record for water

supply to the project area exists, the study must continue through 1996. The USGS has been contracted to assist in streamflow measurement for 1995 since it is the official federal agency for collecting streamflow data.

Implementation Strategy

Following the conclusion of water supply measurement in fall of 1996 a determination will be made as to the feasibility of the project. Costs of construction following completion of the study must be weighed against the value of benefits provided by the project at that time. The cost of water storage projects has increased dramatically since 1968 when the SCS made its estimate. It is conceivable that factors such as the increasing value of native populations of arctic grayling and westslope cutthroat trout coupled by the securing of new sources of funding could make the project feasible from a financial standpoint in the future. Water supply measurement will commence for the 1995 season in April to ensure that a complete runoff event is recorded. (In 1994, study commenced in May and missed snowpack runoff).

Summary

The Ruby Creek storage proposal has a number of unique potential benefits that distinguish it from typical water storage proposals. In addition to providing supplemental irrigation water to area irrigators, the project serves to preserve the land use patterns and ownership in the Upper Big Hole Valley, may provide long-term protection of spawning and rearing habitat for the last remaining native arctic grayling population, may provide similar benefits for small alpine populations of native westslope cutthroat trout, and may provide additional recreational opportunities to users of federal lands in the form of flatwater recreation.

2) CHERRY CREEK RESERVOIR PROJECT

The proposed project site is located approximately 3 miles northeast of the town of Terry, in the Cherry Creek drainage. Terry is located on the Yellowstone River, midway between the cities of Miles City and Glendive.

Description

The Cherry Creek drainage is comprised of approximately 384 square miles of rolling hills in northern Prairie County. Most of the runoff into Cherry Creek takes place as snow melts in February, March, and April, and is supplemented by spring rains in May and June. Summer recharge comes from subsurface storage in higher elevations but is not enough to offset summer evaporation. Bureau of Reclamation (BOR) hydrologists estimate annual yield to the dam site at 4900 acre feet of water.

Background

BLM conceived the idea of constructing a reservoir on the Cherry Creek drainage as part of its commitment to improve access to recreational opportunities on public lands. The site was selected due to its favorable topography, soils, and location to satisfy public demand for fishing, boating, waterskiing, camping, picnicking, hiking, hunting, and other outdoor activities. BLM committed $150,000 to study the feasibility of the project in 1989, and the state legislature appropriated another $100,000 that was matched with $50,000 from "Friends for Cherry Creek Dam, Inc." of the City of Terry.

A partnership was established among the "Friends," the Department of Fish, Wildlife and Parks, and BLM. BLM contracted with BOR to provide technical data, including cost estimates, hydrology and reservoir operation studies, flood hazard determinations, geologic reports, surveying and mapping, and analyses for pumping supplemental water from the Yellowstone River. BOR identified four possible dam sites and sizes and the 50-foot pool depth option was selected. This option will provide a reservoir capacity of 14,078 acre-feet of water with a surface area of 569 acres and meet all three stated objectives, which include sustenance of a fishery, area adequate to provide quality recreation use, and a useful reservoir life of more than 50 years.

Current Status

A water right application was filed for the project with DNRC in December of 1990. No objections to the application were received during the public comment period. Approval of the permit will be granted, subject to the findings of a joint DNRC/BLM environmental impact statement. The project is currently on hold pending acquisition of funding for completion of the EIS. A cultural study is being completed to meet the requirements of the National Environmental Protection Act the National Historic Preservation Act. The Montana Bureau of Mines and Geology has been contracted to drill test wells in the area of the proposed reservoir to determine seepage and water source capacity. USGS is conducting studies of instream flow, sedimentation potential, and salinity. These reports are being finalized and are expected to be submitted to BLM in mid-January.

Implementation Strategy

Cost estimates have been completed by BOR for construction of the earth-filled dam embankment, a gated outlet works, a service spillway, an auxiliary spillway, project design, and construction-related expenses. The 50-foot reservoir will have an estimated life of 136 years and will cost $13.5 million. The recreational facilities will be maintained by BLM, private contractors, and by local volunteers.

Summary

Cost-benefit analysis over the life of the project indicate that the 50-foot pool depth option may have positive returns on investment while accomplishing all three project objectives. The project would stimulate the depressed economies of Prairie County and the City of Terry. The project does not require funding from the state. While the project is reported to be technically feasible, prospects for obtaining funding for continuation of the project appear unlikely.

V. PROGRESS OF ONGOING STORAGE REHABILITATION PROJECTS

Rehabilitation of several water storage projects was in progress prior to the effective date of the state's new water storage policy and legislation. The work is in conformance with new storage policy priorities because it involves the rehabilitation of dams classified as *high-hazard* and *unsafe*. To meet the requirements of the water storage legislation, a progress report on the developments regarding these projects is included.

MIDDLE CREEK DAM REHABILITATION

Middle Creek Dam is located 15 miles south of Bozeman in Gallatin County. The dam forms Hyalite Reservoir, named for the Hyalite Peaks of the Gallatin Range.

Background and Summary

Middle Creek Dam was completed in 1951 by the state Water Conservation Board. The 105 foot-high earthen structure could impound more than 7,880 acre-feet of water. The water users increased the capacity to 8,267 acre-feet by adding flashboards. The dam is owned by the state of Montana and administered by DNRC. The Middle Creek Water Users Association contracts with DNRC for water stored in the reservoir and is responsible for repaying capital investments and operation and maintenance. The reservoir is the principal source of municipal water for the City of Bozeman.

A study of the work needed to bring Middle Creek Dam into compliance with current dam safety standards was completed in 1985. An undersized spillway resulted in the dam being classified as *unsafe*. The dam is classified *high-hazard* due to the potential for loss of life in the event of failure. In 1987, DNRC applied to BOR for a Small Reclamation Projects Loan. The loan was approved and the project was funded by Congress. Approximately 25 percent of the project funds were allocated from the DNRC rehabilitation budget. DNRC awarded a contract for the project in January, 1991, and construction began in May of 1991. The cost of rehabilitating Middle Creek Dam was $5.2 million. The project was complete in October of 1992 with the dedication by Governor Stephens.

The rehabilitation raised the earthfill dam embankment by 10 feet and the reservoir pool level by 8.2 feet, creating a capacity of 10,184 acre-feet. An earthen emergency spillway was constructed in the left abutment. A reinforced wall system with conventional earth fill at each end was constructed to raise the dam embankment 10 feet. Upper and lower auxiliary spillways were constructed in 1992. A new campground was completed in 1991 and a day-use area was completed in 1992. The project increased reservoir capacity while repairing and rehabilitating an *unsafe* dam that has been classified as *high-hazard*. Work was performed in 1993 to correct a seepage problem. The reservoir was filled for the first time in the spring of 1994.

LIMA DAM REHABILITATION

Lima Dam is located on the Red Rock River approximately 15 miles east of the town of Lima in extreme southwest Montana.

Description

Lima dam is an earth embankment structure, 54 feet high and 455 feet long. The dam is able to impound approximately 84,000 acre-feet of water. The average storage has been approximately 27,000 acre-feet. The water from the dam is used to irrigate 16,221 acres in the Red Rock River Valley.

Background

The dam was originally constructed in 1890 and rebuilt in 1909 and 1933. The dam is currently owned by the Beaverhead County Red Rock River Water and Sewer District and is operated under a cooperative agreement by Water Users Irrigation Company, a consortium of twenty-six irrigators.

Lima Dam was inspected by the U.S. Army Corps of Engineers in 1980 under the National Dam Inspection Program and was classified as *high hazard.* Failure of the dam would result in a significant loss of property and human life.

In order to bring the dam into compliance with current dam safety standards, major structural repairs were necessary. The primary deficiency was the inadequacy of the spillway to pass large floods. It was decided that the most economic alternative was to cover the downstream face with roller compacted concrete (RCC) to provide protection against overtopping of the dam. Major reconstruction of the outlet works, including replacement of the tunnels, control gates and control tower were also proposed.

Construction began on the project in the fall of 1992. RCC was placed on the downstream face of both the spillway and the dam. However, shortly after placement of the RCC, problems began to develop. Major portions of the RCC began to deteriorate, particularly in the spillway. It was determined that the RCC was of inferior quality, and the contractor was required to return to the site. The spillway floor was completely replaced with higher strength conventional concrete. Deteriorating RCC on the sides of the spillway was covered with shotcrete, and the downstream face of the dam covered with earth and seeded to prevent additional erosion.

The project was officially completed in the fall of 1994. However, some issues still remain between the water users and the vendors of the outlet tunnels and control gates. Apparently, the actual capacity of the outlet works does not agree with the vendors claim.

This issue is currently under litigation.

In addition to its importance for irrigation, Lima Reservoir is important to wildlife management in southwest Montana. The reservoir and the migratory birds it attracts comprise important habitat for the peregrine falcon, an endangered species. Most of the six nesting pairs of peregrine falcons were bred in captivity and released in the area as part of a national species repatriation program. The reservoir supports the largest population of non-breeding, molting Canada Geese in the northern Rockies. The reservoir is also used by about 100 young molting trumpeter swans and 20 pairs of adult trumpeters nest in the area. The area also serves as a nesting and roosting area for many sandhill cranes and as prime habitat for bald eagles.

Lima Reservoir is the furthest upriver storage reservoir on the Missouri River system and plays an important part in the regulation of the Red Rock River. Although the dam has limited flood control capability, it can serve to augment instream flow in the Red Rock River, helping to restore and sustain a viable trout fishery. The reservoir assists in the recharge of groundwater in the area.

Current Status

Now that the rehabilitation to Lima Dam has been substantially completed, a five-year operation permit, as defined under the Montana Dam Safety Law will be issued.

COMO LAKE DAM REPAIR AND REHABILITATION

Como Lake Dam is located on the east slope of the Bitterroot Range, approximately 15 miles south of Hamilton in extreme western Montana. The reservoir, Lake Como, is fed by Rock Creek, a mountain stream that drains an alpine valley originating on the Idaho border.

Description

Como Dam is an earth-filled dam built between 1908 and 1910 by local irrigators and owned by the Bitterroot Irrigation Company. The dam measures 70 feet high and has a crest length of 2,565 feet. Lake Como's total storage capacity is 35,600 acre-feet and its surface area is 913 acres. Water is released from Lake Como during the summer to irrigate 16,635 acres of land within the Bitterroot Irrigation District for the production of alfalfa, grain, and livestock pasture.

Background

Lake Como's water is stored during the spring when the drainage's mountain snowpack melts. The lake provides a variety of flatwater recreation opportunities to residents of Ravalli County and the state. The site's average annual precipitation is 13 inches. By September the reservoir portion of the lake is nearly empty.

The existing spillway, constructed in 1923 and modified in 1976, is located at the dam's left abutment. The spillway has a discharge capacity of 5,460 cubic feet per second. It consists of a concrete control and transition section with flashboard bays, a concrete chute, a natural rock stilling basin, and a downstream channel. A steel bridge spans the spillway to provide access to the Forest Service recreational facilities that include a boat launch ramp, a paved access road and parking area, beaches, camp sites, and trails. The Forest Service is currently designing and developing additional recreation facilities at Lake Como.

Since 1984, Como Dam has undergone detailed and intensive investigations under the federal Safety of Dams Program. Observations made during reservoir filling and draw-down cycles of the past three years have provided documentation of more than 50 recorded physical symptoms indicating movement within the dam embankment. This may be evidence that widespread internal erosion of foundation materials is taking place, which eventually could cause the dam to fail.

The acceleration of abnormal conditions observed in 1991 indicated that it was no longer safe to operate the dam in the normal manner. Lake Como's water surface elevation was lowered by 8.7 feet during the 1991 irrigation season resulting in a reduction in reservoir capacity of 8,000 acre-feet (25 percent). In 1992, as the reservoir filled to the restricted level, continuing evidence of extreme stress indicated that a progressive dam failure could be taking place. On June 19, 1992, emergency draw-down of the reservoir was begun.

Seismic investigations at Como Dam have revealed that the materials and methods used in constructing the dam in 1910 are vulnerable to the phenomenon known as liquefaction. Under liquefaction, low-density materials such as those that comprise the Como Dam embankment lose their supportive strength and assume the physical properties of a fluid. Como Dam shows a significant risk of failure during an earthquake because the associated shaking of the ground causes liquefaction.

A hydrologic evaluation of Como Dam has indicated additional potentially hazardous conditions. For Como Dam, the probable maximum flood (PMF) caused by a severe thunderstorm presents the most severe scenario for inhabitants of the floodplain below the dam. It is estimated that a flood exceeding 67 percent of the PMF for a thunderstorm would overtop Como Dam and cause it to fail.

Current Status

On July 27, 1992, the Bureau of Reclamation (BOR) completed a Safety of Dam modification report on Como Dam that went to Congress on August 17, 1992. On August 14, 1992, a basis of negotiation for repayment by the Bitterroot Irrigation District of 15 percent of Safety of Dam program costs was approved by the district and the Commissioner of BOR. The 1993 Water and Energy Appropriation Bill waived the required 60-day Congressional review required for the expenditure of construction funds.

On August 25, 1992, the primary construction contract was awarded to Barnard Construction Company, Inc. of Bozeman for $2.9 million. Construction of features that provide embankment stability and prevent internal erosion of embankment and foundation materials were completed in 1994.

Summary

The design and construction technology used in 1910 were directly responsible for the internal erosion of materials at Como Dam. Methods employed during construction are now known to contribute to unstable embankments that can slump and fail during earthquakes. The repair of Como Dam was of great concern to the people of Ravalli County and of Montana. The Como Dam repair project represents a successful, coordinated response to a potentially catastrophic situation.

VI. APPENDIX "A" JUSTIFICATION FOR PROJECT PRIORITIZATION

The governor's report must include a list of water storage priorities and an implementation strategy for each priority project that identifies the necessary resources and government actions. Statutory criteria have been referenced for each project in its respective section as well. The following project prioritization includes grant and loan proposals.

The Tongue River Dam rehabilitation is the first project grant ever funded by the newly-created state water storage development special revenue account. The entire proceeds of the account will be used for this project if the funding recommendation is approved by the legislature.

The remaining project proposals have been recommended for grants and/or loans from the Renewable Resource Grant and Loan (RRGL) program. The RRGL program has its own set of criteria for the ranking of applications with water storage proposals receiving highest priority. The following section provides the legislature with the list of water storage priorities using the statutory criteria of 85-1-704 MCA as a guide.

Reported Projects Not Included in the Project Ranking Summary

The Middle Creek Dam and the Lima Dam rehabilitation projects are not included in the ranking analysis because they were in progress prior to July 1991, the effective date of Section 85-1-704 MCA. They are included in the report because the water policy statute requires a "progress report on the development of water storage projects during the previous 2 years." Both projects are consistent with current policy because they involved the rehabilitation of *high-hazard*, *unsafe* dams.

The Como Lake Dam rehabilitation project is not included in the following analysis because the project is funded by the federal government under the auspices of the U.S. Bureau of Reclamation Safety of Dams program and has been completed. A financing arrangement was negotiated for a 15 percent repayment by the Bitterroot Irrigation District, which owns the dam.

The Ruby Creek Reservoir Storage proposal is the only new storage project since the 1993 "Water Storage Report." The project requires data collection by BOR through 1996. At that time, the data will be assessed to determine whether additional data are required to complete the feasibility study.

The Cherry Creek Reservoir proposal was included in the 1993 "Water Storage Report" as a new storage project. It is included as a "new" project in this report because no facility exists at the proposed site. The project is still being studied for feasibility. At present, the project's sponsors have been unable to secure additional funding to proceed past the study stage.

Projects Prioritized by Statutory Criteria (85-1-704 (2-4) MCA).

The following proposed rehabilitation projects are prioritized by DNRC according to the criteria identified by Montana Code Annotated (MCA) listed at the beginning of this report.

State-owned Rehabilitation Projects

1) Tongue River Dam Rehabilitation

This project has been the highest water storage priority since it was identified as such by Governor Stephens in 1990. A moderate flood in 1978 caused $1,000,000 damage to the spillway and demonstrated the potential for disaster on a large scale. The dam has been classified by the Army Corps of Engineers as a *high-hazard* dam because its failure would jeopardize 7,000 human lives. The Corps further classified the dam as *unsafe* due to the spillway's inability to handle water from a probable maximum flood (PMF). Flows would top the dam crest. The dam's rehabilitation will greatly contribute to the settlement of the federal water rights of the Northern Cheyenne Tribe. The proposed 1996-97 biennium funding arrangement for the Tongue River Dam rehabilitation project calls for $2,360,000 from water development funds and from the water storage account and $31,865,000 in federal funds for construction, mitigation, and enhancement.

2) Petrolia Dam Rehabilitation

It is likely that DNRC will not be able to obtain an operating permit for Petrolia Dam because of the insufficient capacity and deteriorated condition of the dam's spillway. This means that the project may not be able to store irrigation water until the project is rehabilitated. This will pose a severe hardship for the Petrolia Water Users Association and have a negative impact on the economy of Petrolia County.

The estimated total construction cost is $1,434,000 which includes replacing the existing spillway, construction of a new auxiliary spillway, and seepage control in the embankment and left abutment. DNRC has budgeted $1,076,000 for rehabilitation and the Petrolia Water Users Association will pay the balance of $358,000 through a loan.

3) Bearpaw Lake Dam Rehabilitation

Bearpaw Lake Dam is owned and operated by the Department of Fish, Wildlife, and Parks (DFWP) as a recreational facility. DFWP obtained funding from the 1993 Legislature to rehabilitate the dam. The Corps classified the dam as "intermediate" in size with a "significant downstream hazard" potential. In 1989, the dam was classified as *high-hazard* under Montana Dam Safety Act guidelines. A Corps study of the Bearpaw Dam indicated that the dam would be overtopped when 9 percent of the probable maximum flood (PMF) takes place. Two hundred sixty thousand dollars was appropriated by the 1993 legislature for rehabilitation of the dam. Final design was completed in 1994 and construction is scheduled for July 1995.

4) North Fork of the Smith River Rehabilitation

The Corps has classified the dam as *high-hazard* due to the potential for loss of life and *unsafe* due to inadequate spillway capacity. In addition to public safety considerations, the project is important to agriculture and the regional economy. An RRGL loan of $1,393,467 was approved by the 1993 legislature. Since then, the project scope has been revised. The revised project will rehabilitate and increase the capacity of the existing principal spillway, construct an auxiliary spillway, level the dam crest, and improve seepage collection at the dam. DNRC will negotiate with the Smith River Water Users Association for repayment of the requested revenue bond. The rehabilitation will provide a safe structure and cost between $250,000 and $500,000. Construction is expected to begin in the fall of 1996.

5) **Deadman's Basin Water Quality Improvement Project**

Deadman's Basin Reservoir is owned by DNRC and operated and maintained by the Deadman's Basin Water Users Association (DBWUA). Water is released from the project through two canals: the Careless Creek Canal and the Barber Canal. The proposed rehabilitation project will increase the capacity of the Barber Canal from 200 to 300 cubic feet per second (cfs). This will enable the project to decrease the flow in the Careless Creek Canal (and Careless Creek) from 250 to 150 cfs.

The ability to decrease flow in the Careless Creek Canal will enable the project to meet Environmental Protection Agency (EPA) water quality standards in Careless Creek. The EPA has apprised DBWUA that presently these standards are routinely violated in Careless Creek by erosion caused by the 250 cfs flow. The proposed rehabilitation of the Barber Canal will reallocate enough flow from the Careless Creek Canal to the Barber Canal to meet water quality standards in Careless Creek. By proceeding with the Barber Canal project in a timely manner, the Lower Musselshell Conservation District will qualify for Department of Health and Environmental Sciences 319 funding for Careless Creek rehabilitation.

Rehabilitation Projects Not Owned by State:

1) **Lower Baker Lake Spillway Rehabilitation**

The Army Corps of Engineers has classified Lower Baker Dam as *high hazard* and *unsafe*. The proposed rehabilitation project involves replacing the existing spillway to meet requirements of the Montana Dam Safety Act. Fallon County has requested a grant from the Renewable Resource Grant and Loan Program in the amount of $31,742.76. The program has recommended that the legislature approve a grant of $15,908 and a loan of $15,835. Fallon County has proposed to contribute an in-kind match for administration, surveying, labor, equipment, and materials.

2) **Lake Francis East Dam Rehabilitation**

Lake Francis is owned and operated by the Pondera County Canal and Reservoir Company. The City of Conrad obtains its entire municipal water supply from the reservoir. The Army Corps of Engineers has classified the dam as *high-hazard* because its failure has potential for loss of human life. The dam could fail if it became saturated by a leak occurring in the pressurized pipeline located within the dam. The proposed improvements would address this potential problem while protecting Conrad's water supply. The proposed improvements include excavation in the existing pool below the dam, installation of intake piping, relocating existing pumps, and adding a new pump, pump house, discharge piping, and controls. The total estimated project cost is $360,000 (based on 1996 dollars). The City of Conrad is seeking a $100,000 Renewable Resource grant.

3) **Lone Tree Dams Rehabilitation Study**

In 1993, Richland County's proposal for this dam rehabilitation study received a RRGL grant of $60,850. The Corps classified the two Lone Tree Dams as *unsafe* due to the inability of the spillways at both dams to route the probable maximum flood (PMF), and *high hazard* because of the threat to human life in the event of dam failure. The town of Sidney could sustain significant loss of life and negative economic impacts if the dams failed.

The dams would continue to provide water for irrigation and flood protection if the study indicates that rehabilitation is a viable alternative. Indications of broad public support for the study are present and a wide range of recreational opportunities would be available if public access can be arranged. The owner of the dams, Lone Tree Ranch, Inc., has committed about 15 percent of the funds needed for the study and as potential project beneficiaries, Richland County and Sidney will contribute to the study costs. The engineering study is necessary before an alternative can be selected. The geotechnical report is finished and the final construction drawings are expected to be completed in January of 1995.

4) **Tin Cup Lake Dam Rehabilitation**

A $302,204 RRGL loan was approved by the 1993 Legislature for the dam's rehabilitation. The dam has been classified as *unsafe* by the Corps, the Forest Service and DNRC due to inadequate spillway capacity. It is classified as *high-hazard* due to the potential for loss of life in the event of failure. The dam is owned and operated by the Tin Cup Water Users Company and repayment of the loan will be made from user fee proceeds. The dam is located entirely within the boundaries of the Selway-Bitterroot Wilderness Area and supplies water to 1,300 acres of farmland in the Bitterroot Valley. Additional benefits of the dam include limited flood control, ground water recharge, enhancement of instream flows for fisheries, public recreation opportunities, and improved water quality through the control of streambank erosion and stream sedimentation. The Tin Cup Water Company is in the process of becoming a public entity to qualify for use of their approved loan.

5) **Malta Irrigation District Canal Efficiency Improvement**

The Malta Irrigation District received a RRGL $50,000 grant. The estimated cost of the proposed project is $498,000. The $398,000 difference will be covered by the Malta Irrigation District through user fees.

It is estimated that the project would increase annual storage by 13,000 acre-feet of water at Nelson Reservoir. Full storage must be concluded before the nesting period of the piping plover, a "threatened species" under the Endangered Species Act. A Bureau of Reclamation study of the Malta Irrigation District irrigation system found that new check structures at Dodson Canal South were critical to keeping the area's water distribution system operational.

The proposed project will rehabilitate and increase the efficiency of a water conveyance and distribution system. The proposal will provide more water for irrigation, migratory bird habitat, fishery habitat, and recreation. Increased water storage at Bowdoin National Wildlife Refuge is another project benefit stated in the grant application. No citizen opposition to the project has been documented. Three of the eight structures have been installed. Two others are 50% completed and are expected to be finished by April of 1995. Two more are expected to be installed in 1996 and the final structure is expected to be constructed in April of 1997.